Disdrometer and Rain Gauge Implementation and Operational Plan

TRMM Kwajalein Experiment

Prepared by
Ali Tokay
Joint Center for Earth Systems Technology
The University of Maryland at Baltimore County

Contributions by
Otto W. Thiele, Brad L.Fisher, David B. Wolff, and Jerry Wang of
TRMM Office, NASA Goddard Space Flight Center
Paul Bashor of NASA Wallops Island Facility
Anton Kruger of The University of Iowa

DRAFT

July 1, 1999

Introduction

This document describes the various aspects of the disdrometer and rain gauge operation during the NASA Tropical Rainfall Measuring Mission (TRMM) Kwajalein experiment, (KWAJEX). KWAJEX will be conducted over the open tropical ocean in the vicinity of the Kwajalein atoll, Republic of Marshall Islands (RMI) between July 23 and September 15, 1999. The experiment is designed to support the TRMM satellite program.

As part of the TRMM Kwajalein ground validation (GV) network, 17 tipping bucket rain gauges are currently operated by two agencies sponsored by the NASA Goddard Space Flight Center. The Republic of Marshall Islands Weather Service (RMI-WS), which is sub-contracted to the Pacific Region of National Weather Service (NWS), operates 10 gauges located at Lae-Lae, Woja-Ailinglapalap, Lib1-Lib, Lib2-Lib, Namu-Namu, Majkin-Namu, Loen-Namu, Mejatio-Kwajalein, Yabbernohr-Kwajalein, and Biggarenn-Kwajalein. Aeromet Inc. which is sub-contracted to the US Army Kwajalein Missile Range (KMR) operates 7 gauges located in the Kwajalein atoll, Carlos, Meck, Legan, Illeginni, Gagan, Roi-Namur and Kwajalein (Fig.1).

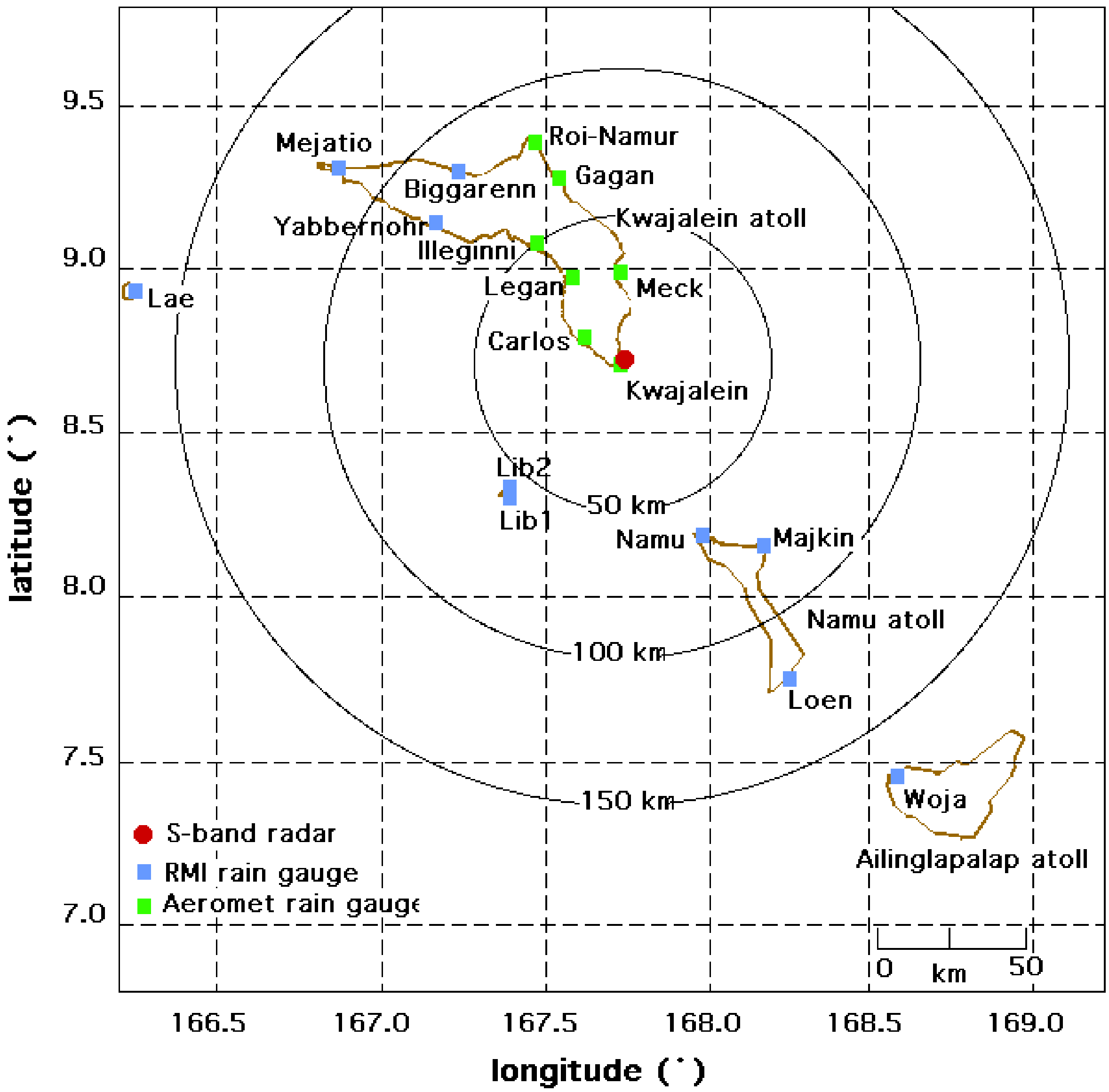

Fig. 1. TRMM Kwajalein ground validation (GV) network.

So far, about two years of rainfall data were collected from 17 gauges. However, there is quite a bit of discrepancy in the rain record particularly from the gauges operated by RMI-WS operation. There is also inconsistency between rain totals that were derived from Kwajalein Doppler radar and those from rain gauges. Examination of the monthly *gauge* rain totals from July to September 1998, two outer atolls, Woja-Ailinglaplap and Lae-Lae, had substantial rainfall ranging from 175 to near 440 mm/month. At Namu atoll, Loen was the rainiest site receiving more than 250 mm/month, while Majkin received less than 60 mm/month. At Kwajalein atoll, the southern region (i.e. Carlos and Kwajalein) was rainiest receiving 180 to 310 mm/month, while it was rather less rainy (10 to 90 mm/month) in the central region (i.e Meck and Legan). The northern region (i.e. Roi-Namur and Gagan) of the atoll, on the other hand, had a substantial rainfall particularly in July, ranging from 220 to 270 mm. Rainfall data were not available for the three sites in northwestern Kwajalein atoll and for Lib Island for this period. The monthly *gauge* rain totals of the TRMM Kwajalein GV network from July to September 1998 can be found in Fig. 2a,b,c.

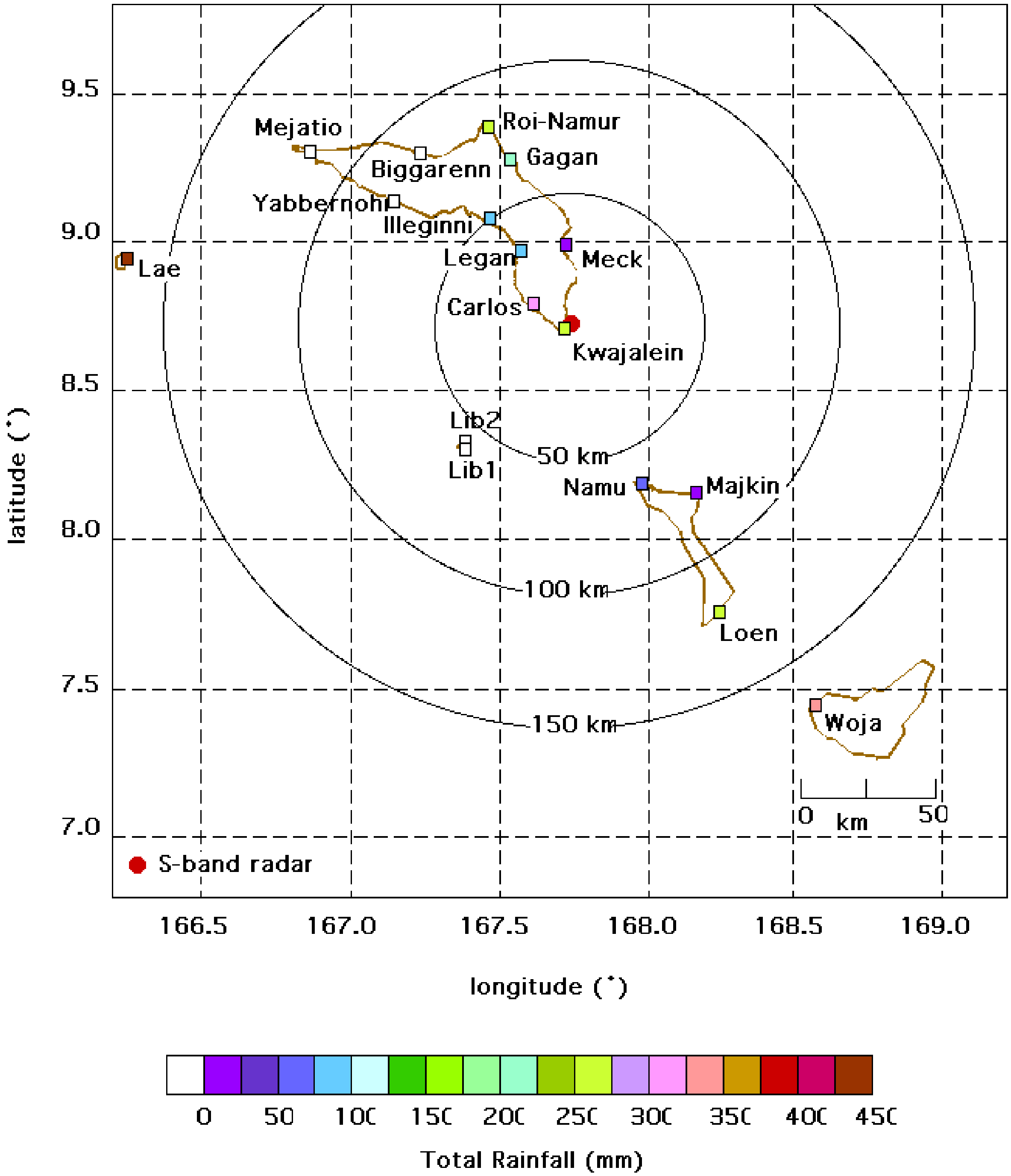

Fig. 2a. Monthly rain totals (mm) for July 98 in TRMM Kwajalein GV network.

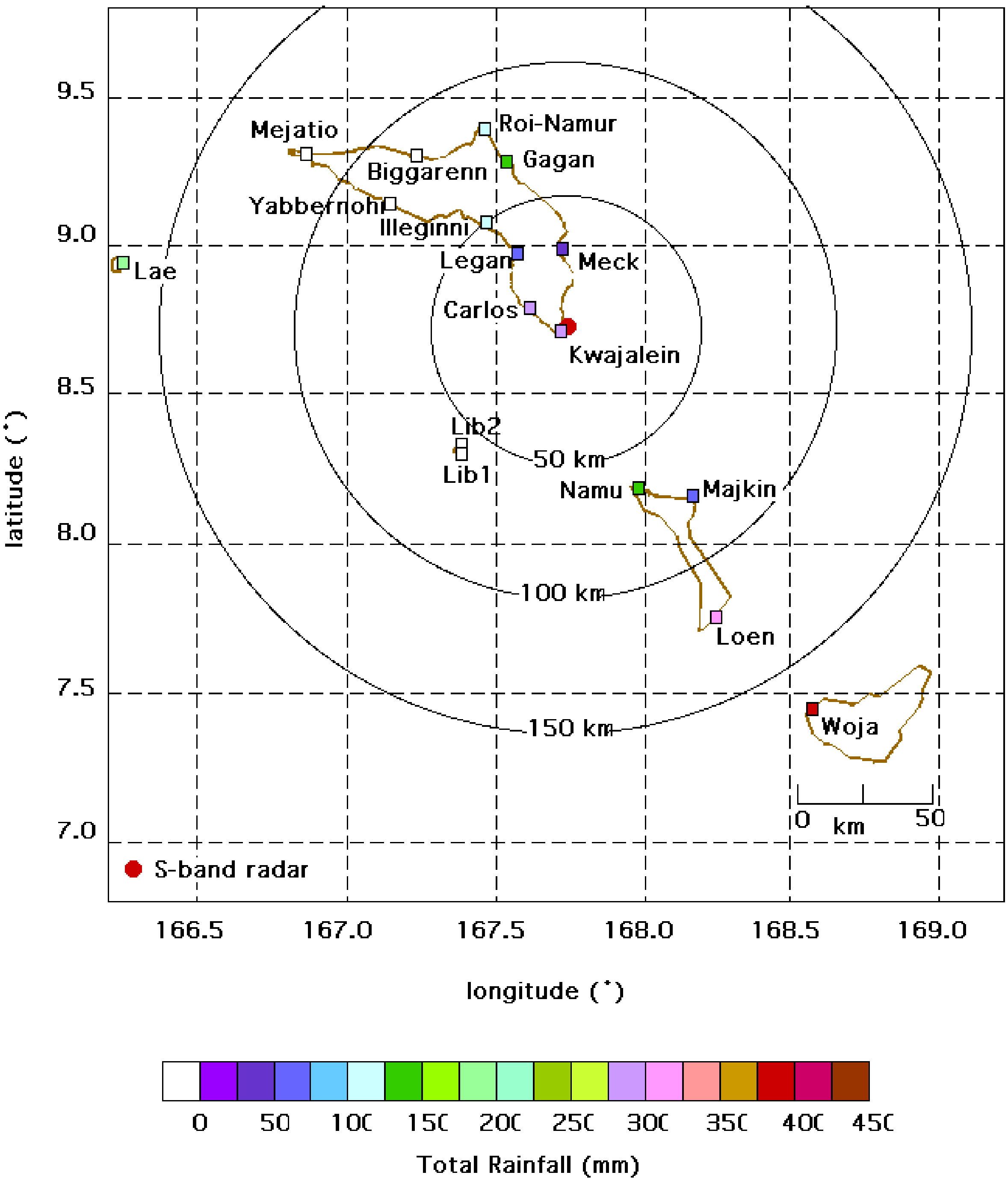

Fig. 2b. Monthly rain totals (mm) for August 98 in TRMM Kwajalein GV network.

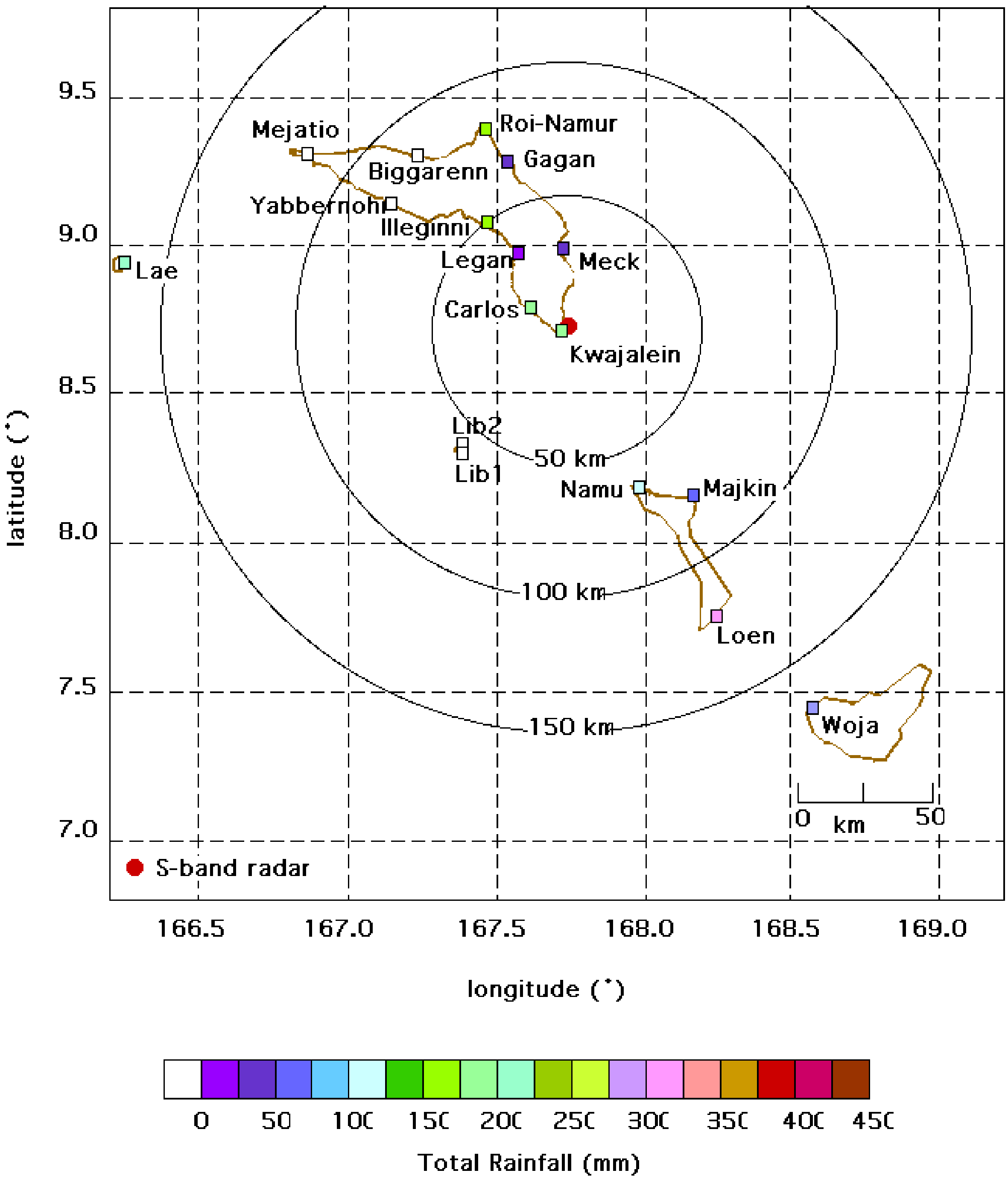

Fig. 2c. Monthly rain totals (mm) for September 98 in TRMM GV network.

This document consists of three sections. The first section briefly describes each instrument as part of the disdrometer/rain gauge operation. It also provides information regarding quantity and location of the instruments in the field. The second section describes the operational procedure and policy of data collection for each instrument. The last section lists the participants involved in the operation of the disdrometers and gauges including their dates of participation.

Instruments

During KWAJEX, the gauge and disdrometer land base operation will have up to 41 tipping bucket rain gauges, 2 two-dimensional video disdrometers, 6 JHU/APL disdrometers, and two to four RD-69 (Joss-Waldvogel) disdrometers. In addition, there will be siphon rain gauges on both the west and the east buoys along with a JHU/APL disdrometer on each. Siphon gauges and two JHU/APL disdrometers will be deployed on board the NOAA research vessel, Ron Brown. The location of each unit can be found in Fig. 3.

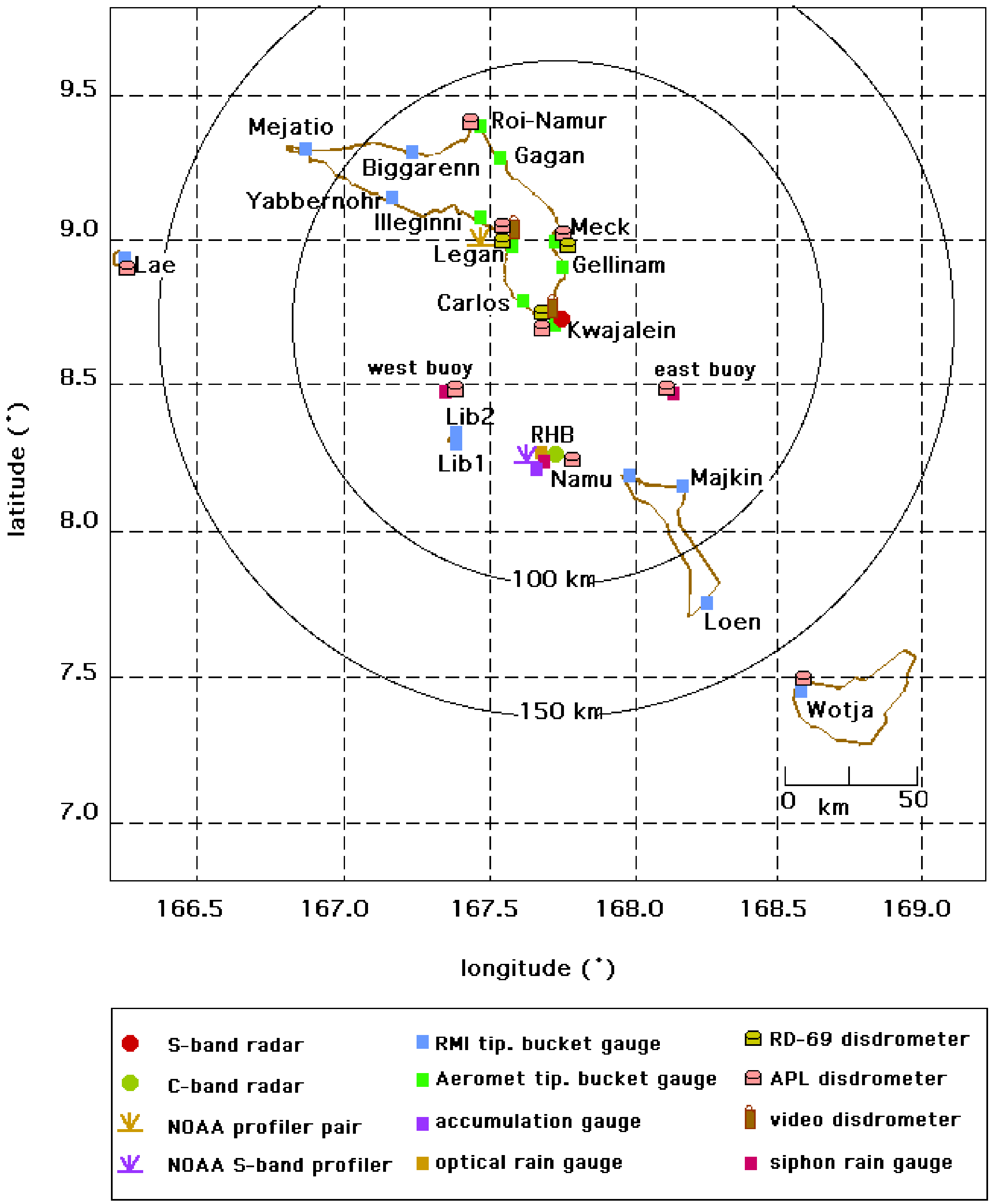

Fig. 3. KWAJEX disdrometer and rain gauge obervational network.

Tipping bucket rain gauge

The tipping bucket rain gauge is designed to provide a continuous record of rain rate by recording the time of each tip. Each tip corresponds to 0.254 mm of rainfall. The gauge is manufactured by the Qualimetrics Inc, Sacramento, California, and has proven to be very reliable. Nevertheless, it should be noted that under light rain (< 0.5 mm h^{-1}), the time of the tip may not be indicative of the duration of the rainfall. Similarly, the instrument may fail to measure extremely heavy rain (> 300 mm h^{-1}). The tipping bucket rain gauge is connected to a data logger and therefore can be operated unattended. A detail description of the tipping bucket rain gauge can be found in the user's manual.

During KWAJEX, the Aeromet Inc and RMI-WS will continue to operate the gauges as they have in the past for the TRMM Kwajalein GV network. In addition, 24 new tipping bucket gauges will be installed and operated. More specifically, the RMI-WS will install 6 new gauges next to he existing gauges at the following sites: Namu-Majkin, Namu-Namu, Namu-Loen, Kwajalein-Mejatio, Kwajalein-Yabbaernohr, Kwajalein-Biggarenn. TRMM principal investigator (PI) personnel will install two tipping bucket gauges next to the upper-air sounding sites at Lae-Lae, and Woja-Ailinglaplap. The RMI-WS will be responsible for the operation of these 8 new gauges during the experiment. TRMM PI personnel will install 16 more gauges at the following Kwajalein sites: Carlos, Gagan, Legan, Illeginni, Meck, Kwajalein (5), Roi-Namur (4), Gellinam (2). The first five of these new gauges will be located next to the existing gauges. A cluster of gauges will be at Kwjalein and Roi-Namur. The configuration of these gauge clusters is given in Fig. 4. The Aeromet Inc. will assist in the operation of these additional new gauges. The PI personnel will dismount all the gauges that they installed. All 24 new tipping bucket gauges will use a temporary wooden base of about 16x16" and 6" high. Two tipping bucket rain gauges will be on reserve during the experiment. The spare units will be kept at the project office.

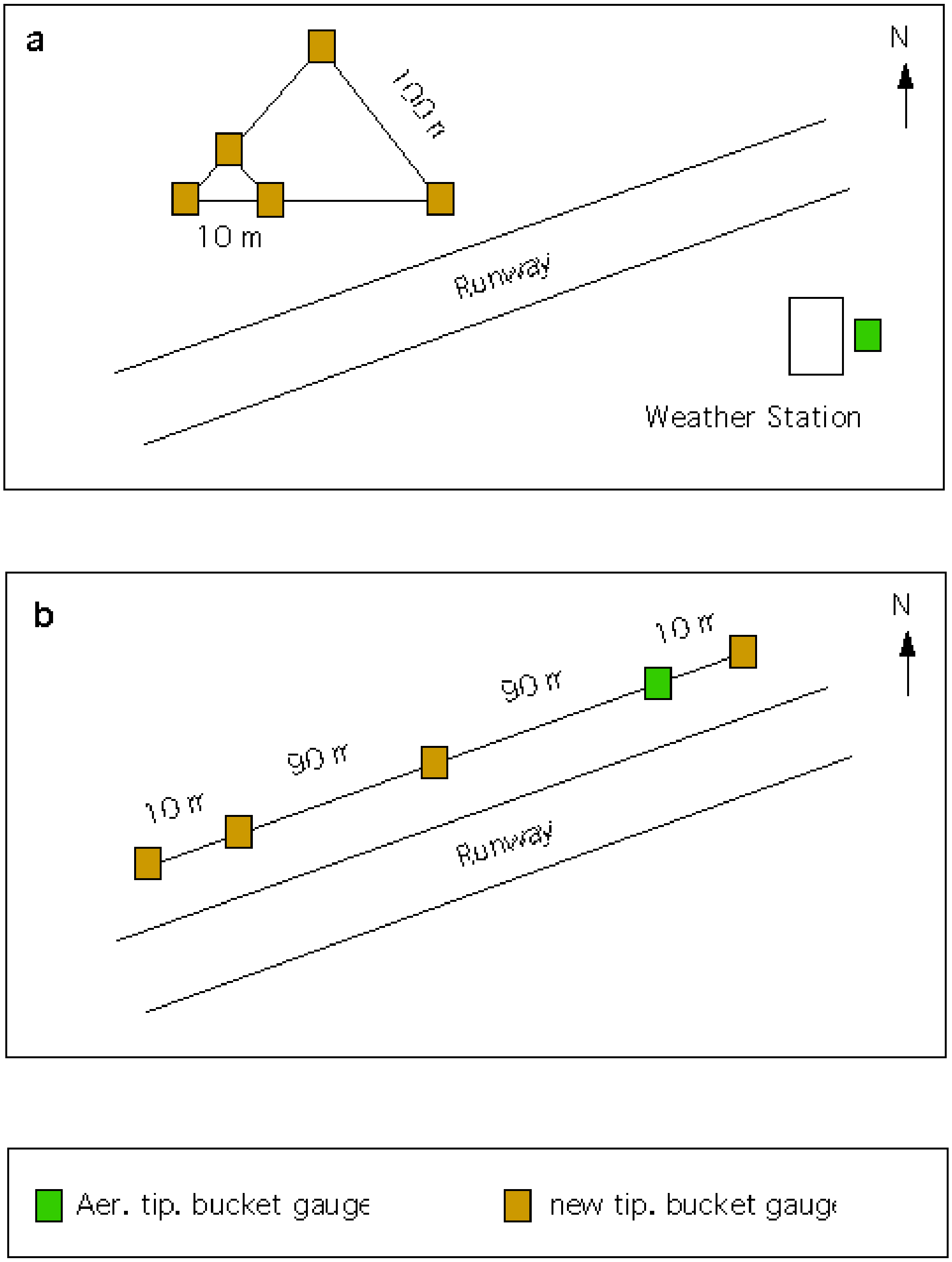

Fig. 4. The configuration of gauge clusters in Kwajalein (a), and Roi-Namur (b).

2-D video disdrometer

The 2-D video disdrometer is an optical device which measures the drop size, drop shape, and drop fall speed. It is manifuctured by the Joanneum Research in Graz, Austria. The disdrometer consists of a sensor unit, an outdoor electronics unit (OEU), and an indoor user terminal (IUT). A cooling unit has been added to keep the electronics at a controlled temperature in hot humid environments. The sensor unit has two light sources that generate orthogonal light sheets. The light sources are projected through narrow slits onto two line-scan digital cameras. Particles falling through the beams of light appear as dark silhouettes against a bright background. The disdrometer has a nominal measuring area of 100 cm^2. More information regarding the description and operation of the 2-D video disdrometer can be found in a manuscript by Schonhuber et al. 1994.

During KWAJEX, two 2-D video disdometer will be operated. One of the units which belongs to the University of Iowa, will be located at Legan, and the other unit which belongs to NASA TRMM office will be located at Kwajalein. Both disdrometers will be installed, operated, and dismounted by TRMM PI personnel.

JHU/APL disdrometer

The JHU/APL disdrometer is an impact type disdrometer. It is a low power unit and is designed to operate unattended such as on buoys. The disdrometer consists of a sensor, analog electronics, and a front-end processor. The sensor converts the momentum of the falling raindrop into an electrical pulse, the amplitude of which is monotonically related to the drop size. The analog electronics amplify, rectify, and logarithmically compress the signal and prepares the signal for digitization at fixed voltage levels. The front-end processor continuously digitizes the conditioned analog output at a high rate, while examining the data for drops. The peak value of each drop is computed and this value is used to increment the counts in to a raindrop size histogram. Once a minute, the front-end processor reports the date, time, and histogram counts via a serial message. The data is recorded to an internal data logger during unattended operation. The processor sorts the digital output into 24 channels of drop diameter ranging from about 1 to 7 mm. The range of drop size is very sensitive to the calibration procedure. The APL disdrometer has a nominal measuring area of 45.6 cm^2. More information regarding the description, calibration, and operation of the JHU/APL disdrometer can be found in several JHU/APL technical reports by Chapman and Jose (1997), Chapman, Furness, and Chamberlain (1997), available through http://fermi.jhuapl.edu/people/chapman/disdromPubs.html.

During KWAJEX, 10 JHU/APL disdrometers will be operated and two will be on reserve. Six of them will be next to the upper-air sounding and profiler sites at Lae, Woja-Ailinglaplap, and the Kwajalein islets of Roi-Namur, Meck, Legan, and Kwajalein. As indicated earlier, two JHU/APL disdrometers will be installed on the ship and the two NOAA TAO buoys as well. All JHU/APL disdrometers except on the buoys will use a temporary wooden base of 12x24” and 6” high. They will be installed, operated, and dismounted by TRMM PI personnel. Two reserve disdrometers, with some extra parts, will be located at the project office.

RD-69 Distromet disdrometer

The RD-69 disdrometer is also an impact type disdrometer, and is manufactured by Distromet Inc. in Zurich, Switzerland. The disdrometer was originally designed to measure drop size distribution for the purpose of calculating radar reflectivities (Joss and Waldvogel 1967). It has performed this function successfully for about 30 years. The disdrometer is also used to assess microphysical processes such as evaporation, coalescence and the evolution of drop size distributions (Tokay and Short 1996). The RD-69 disdrometer consists of a sensor head and signal processing electronics. The sensor head consists of a thin aluminum surface covering a styrofoam body. It transmits the mechanical impulse of an impacting drop to a set of two moving coil systems. A voltage is induced in the sensing coil and is amplified. The amplitude of the amplified voltage is compressed by signal processing electronics providing a compressed voltage that can be expressed as a function of raindrop size. A pulse height analyzer sorts the peak amplitudes into 20 channels of drop diameters ranging from 0.3 mm to about 5.5 mm. The RD-69 disdrometer has a sampling area of 50 cm^2. More information regarding description, calibration, and operation of the RD-69 disdrometer can be found in the literature (e.g. Joss and Waldvogel 1969, Kinnel 1976, Sheppard, 1990) and the Distromet user manual.

During KWAJEX, of the four RD-69 disdrometers, one belongs to the Department of Atmospheric Sciences, University of Washington and will be installed at Kwajalein, operated, and dismounted by their personnel. The second unit, which is leased from Distromet Inc., will be installed at Legan, operated, and dismounted by the NOAA Aeronomy Laboratory personnel. The third unit, which belongs to the Applied Physical Laboratory at the University of Washington will be installed at Meck, operated, and dismounted by tethersonde/radiosonde personnel if it can be successfully calibrated in time. The fourth unit, which belongs to NASA Goddard Space Flight Center will be installed at Roi-Namur operated, and dismounted by the PI personnel. These two units will sit on a temporary wooden base of the sizes given for tipping bucket rain gauge.

References

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Operation

The operational task is divided into three components: i) installation and calibration, ii) data collection, and iii) dismounting. This document describes the procedure of each of the three components of the operation. However, as of this document is written, some of the details of operation have not been determined. Therefore, the reader may require an additional information that should be directed to the principal investigator of the relevant instrument.

Tipping bucket rain gauges

A tipping bucket rain gauge unit consists of rain gauge, enclosure, data logger, and two wires. The dimensions and weight of each component of a gauge unit are given in appendix A. The gauge personnel will have a spare data logger, a screwdriver set, gauge/disdrometer notebook, and a portable PC during each visit to the gauges. The *starlog* program must be installed and the PC battery should be fully charged. The general instructions for the rain gauge installation and downloading can be found in appendix B. The starlog user manual will also be available for the gauge personnel. Prior to KWAJEX, all additional rain gauges will be shipped to Kwajalein. The gauges that will be installed by the RMI-WS will further be shipped to Majuro, RMI by air. The gauges that will be installed at Lae and at Woja will be added to the upper-air sounding shipment and will be installed by the sounding personnel. The gauges in the KMR zone will be shipped to the islets of Kwajalein atoll by a helicopter or airplane and will be installed by the PI personnel.

During KWAJEX operation, it is expected that each gauge will be visited a minimum of two times after the installation and before the dismounting. In each visit, the gauge personnel will download the data and take note of local time, weather condition (i. e. no rain, light rain) and the block of the downloaded file. It is desirable to collect gauge data in a rain free environment. In case of any problems, the remarks such as any message on the PC monitor should also be added to the notes. The coordinates of the gauge should be taken during installation and once during data collection. A GPS receiver will be available to the gauge personnel. It is important to note that the data loggers should NOT be re-initialized after the data collection.

2-D video disdrometer

The 2-D video disdrometer consists of sensor unit, OEU, IUT, and cooling unit. An uninterrupted power supply (IPS) unit is planned to be added to the NASA 2-D video disdrometer The dimensions and weight of the each unit of the video disdrometer can be found in appendix A. Both Iowa and NASA video disdrometers will arrive at Kwajalein prior to the experiment. The Iowa unit will then be transported to Legan by boat. The project office will be responsible for the inner island transportation. The PI personnel will install and calibrate first the Iowa and then the NASA disdrometer. The calibration of the video disdrometers is a time consuming process. Therefore, it can easily take one to two days under rain free conditions to complete. The calibration is a two step process: First, the disdrometer should be able to run in the “acquire” mode. The alignment of cameras and lenses is the key for the “acquire” mode. The raw video signals from each camera should be between certain threshold values. The metal spheres should then be dropped, a data calibration file generated, and then placed in the operation directory. The size of the metal spheres should match with the size output of the indoor terminal software graphical interface.

During KWAJEX operations, the video disdrometer data should be archived on a daily basis. This will not be possible for the unit at Legan. It is expected that Legan will be visited by local Raytheon personnel four times a week and the data will be archived each time. The video disdrometers will be re-calibrated once during the experiment and once just before dismounting. The experience from previous field campaigns revealed that video disdrometers fail to operate if not unattended frequently. A list of reasons and solutions for possible failures are given in appendix D. This appendix also includes the layout of the OEU and IUT software directory and the list of parameters in the "acquire" mode file.

JHU/APL disdrometer

The JHU/APL disdrometer unit consists of a sensor, enclosure, battery, and waterproof cable. The weight and dimension of the disdrometer is given in appendix A. The disdrometer personnel will have a spare battery, spare cable, multimeter, a screwdriver set, gauge/idsdrometer notebook, and a portable PC. A standard terminal program must be installed in the PC and ensure that the PC battery is charged. All the JHU/APL disdrometers will be shipped to Kwajalein prior the experiment. Two disdrometers will be sent to Lae and Woja by ship with sounding and gauge equipment. These units will be operated by the sounding personnel. The disdrometers in the KMR zone will be shipped to the Kwajalein atolls by a helicopter or airplane and will be installed and operated by PI personnel. As stated above, two JHU/APL disdrometers will be on board the ship and one on each buoy.

During the KWAJEX operation, it is expected that each JHU/APL disdrometer on land will be visited twice after installation and before the dismounting. In each visit, the disdrometer personnel should download the data and take a note on local time, weather condition (i. e. no rain, light rain) and the size of the downloaded file. It is desirable to collect disdrometer data in a rain free environment. In case of any problem, the remarks such as any message on the PC monitor should also be added to the notes. Experience from past field campaign reveals that the JHU/APL disdrometer electronics were subject to corrosion possibly due to a high humid environment or water entrance in to the unit. Nevertheless, it is important the disdrometers not be opened to diagnose problems, rather they should be replaced by a spare unit as soon as possible. In some cases, the JHU/APL disdrometers records the noise in a rain-free environment. This will quickly fill the flash card. Therefore, the flash card should be erased after the data collection. However, the disdrometer personnel should check the downloaded data before erasing the flash card. The downloading procedure for the JHU/APL disdrometers is given in appendix C.

RD-69 disdrometer

The RD-69 disdrometer unit consists of the outdoor sensor, indoor electronics, and connection cables. The dimensions and weight of a RD-69 disdrometer is given in appendix A. The indoor electronics include a PC where the data will be stored and copied to a floppy disk. This document does not include the operational requirements for the RD-69 disdrometers that will be located at Legan and Kwajalein. These units will be operated by the NOAA Aeronomy Laboratory, and the University of Washington, respectively. As of this document is written, one or two more RD-69 disdrometers may be operated at Roi-Namur and Meck. Both units are expected to arrive Kwajalein prior to the experiment. One of the units will then be shipped to Roi-Namur, next to the sounding site and will be operated by TRMM PI personnel. The other unit will be at Meck next to the tethersonde site and will be operated by tethersonde personnel.

During KWAJEX operation, it is advisable to store the disdrometer data on the PC hard drive two or three times a week. The disdrometer personnel should also check the clock on their PC before dowloading the data. The date and time should be noted in the disdrometer/gauge notebook. In addition, a RD-69 disdrometer user manual will be available for the disdrometer personnel.

<u>TRMM PI Personnel Schedule</u>

Paul Bashor
NASA/ GSFC Wallops Flight Facility, Code 803, Wallops Island, VA 23337
Tel: 757 824-2269, fax: 757 824-1036, e-mail: pgbashor@pop900.gsfc.nasa.gov
July 12 (Monday) - July 23 (Friday)
gauge and JHU/APL disdrometer installation and testing

Paul A. Kucera
404 HL, Iowa Institute of Hydraulic Research, The University of Iowa,
Iowa City, IA, 52242
Tel: 319 335-5216, fax: 319 335-5238 e-mail: pkucera@iihr.uiowa.edu
July 20-21, July 24-August 10
video disdrometers installation and calibration
JHU/APL disdrometer data collection in the ship

Ali Tokay

NASA Goddard Space Flight Center Center, code 910.1, Greenbelt, MD 20771
voice: 301 286 2120, fax: 301 286-1626, e-mail: tokay@trmm.gsfc.nasa.gov
July 24 - August 4 (if approved)
Paul Bashor (back-up)
gauge and disdrometer operation

Brian Nelson
200 HL, Iowa Institute of Hydraulic Research, The University of Iowa,
Iowa City, IA, 52242
tel: 319 335-5216, fax: 319 335-5238, e-mail: bneslon@iihr.uiowa.edu
August 4-20
2-D video disdrometer (primarily) and gauge operation

Dave Wolff
NASA Goddard Space Flight Center, Code 910.1, Greenbelt, MD 20771
Voice: 301 286-3767, fax: 301 286-1626, e-mail: wolff@trmm.gasfc.nasa.gov
August 17-22
gauge and disdrometer operation
JHU/APL disdrometer data collection in the ship

John Hubbert
Department of Electrical Engineering, Colorado State University, Fort Collins, CO
voice: 970 491-7678, fax: 970 491-2249, e-mail: hubbert@engr.colostate.edu
August 24 – September 11
2-D video disdrometer (primarily) and gauge operation

Witord F. Krajewski
Iowa Institute of Hydraulic Research, The University of Iowa, Iowa City, IA, 52242
voice: 319 335-5231, fax: 319 335-5238, e-mail: wfkrajewski@icaen.uiowa.edu
September 9-17
2-D video disdrometer (primarily) operation and dismounting
gauge operation

Brad Fisher
NASA Goddard Space Flight Center, Code 910.1, Greenbelt, MD 20771
Voice: 301 286-8912, fax: 301 286 1626, e-mail: fisher@trmm.gsfc.nasa.gov
September 13-24
NASA 2-D video disdrometer, gauge and JHU/APL disdrometer dismounting

Other related personnel:

Mark P. Ablondi
Pacific Marine Environmental Laboratory, Ocean Climate Research Division,
7600 Sandy Point Way, NE, Building 3, Seattle, WA 98115-0070
voice: 206 526-6403, fax: 206 526-6744, e-mail: ablondi@pmel.noaa.gov

F. Larry Bliven
NASA/ GSFC Wallops Flight Facility, Code 972, Wallops Island, VA 23337
voice: 757 824-1057, fax: 757 824-1036, e-mail: bliven@osb1.wff.nasa.gov

Wendy Whiting Dolci
NASA Ames Research Center, MS 244-30, Moffett Federal Airfield, CA 94035
voice: 650 604-6358, fax: 650 604-1094, email: wdolci@mail.arc.nasa.gov

B. Gene Furness
NASA/GSFC Wallops Flight Facility, Code 803, Wallops Island, VA 23337
Voice: 757 824-1159, fax; 757 824-2146, e-mail: brantley.e.furness.1@gsfc.nasa.gov

Kenneth Gage
NOAA Aeronomy Laboratory, R/E/AL3, 325 Broadway, Boulder CO, 80303-3328
voice: 303 497-3964, fax: 303 497-5373, e-mail: kgage@al.noaa.gov

John Gerlach
NASA/ GSFC Wallops Flight Facility, Code 972, Wallops Island, VA 23337
Voice: 757 824-1515, fax: 757 824-1036, e-mail: gerlach@osb1.wff.nasa.gov

Steve Hipskind
NASA Ames Research Center, Moffett Federal Airfield, CA 94035
voice: 650 604-5076, fax: 605 604-1094, e-mail: shipskind@mail.arc.nasa.go

Anton Kruger
Iowa institute of Hydraulic Research, the University of Iowa, Iowa City, IA, 52242
Voice: 319 335-6287, fax: 319 335-5238, e-mail: kruger@iihr.uiowa.edu

Christian Kummerow
NASA Goddard Space Flight Center, Code 912, Greenbelt, MD 20771
voice: 301 614-6313, fax: 301 614-5484, e-mail: kummerow@agnes.gsfc.nasa.gov

Derek Leeloy
NOAA National Weather Service, 737 Bishop Street, suite #2200,
Honolulu, HI, 96813-2313
voice: 808 532-6439, fax: 808 532-5569, e-mail: Derek.Leeloy@noaa.gov

K. Rhonie LaGarde
NASA/GSFC Wallops Flight Facility, Code 803, Wallops Island, VA 23337
voice: 757 824-1154, fax: 757 824-2146, e-mail: Katherine.R.Lagarde.1@gsfc.nasa.gov

Gerry McIntire
NASA/GSFC Wallops Flight Facility, Code 972, Wallops Island, VA 23337
Voice: 757 824-1889, fax: 757 824-1036, e-mail: mcintire@osb1.wff.nasa.gov

Elliott Moseley
Kwajalein Missile Range, Instrumentation Division, DSN 254-4425
voice: 805-355-4425, fax: 805 355-2468, e-mail: moseleye@smdc.army.mil

Jeffrey Nystuen
Applied Physics Laboratory, University of Washington, 1013 NE 40th Street,
Seattle, WA 98105
voice: 206 543-1343, fax 206 543-6785, e-mail: nystuen@apl.washington.edu

Michael Schonhuber
Joanneum Research, Institute of Applied Systems Technology, Inffeldgasse 12, A-8010 Graz, Austria
voice: 43-316-876–2512, fax: 43-316-876–2502,
e-mail: Michael.Schoenhuber@joanneum.ac.at

Carl Sweetand
ProUD Services, 2703 Day Road, Huntsville, AL 3580
Range Systems Engineering, P.O. Box 11488, Huntsville, AL 35814
voice: 256.539-2959 or 256 955-1873, fax: 256-536-9724 or 256-955-1873,
e-mail: carlswee@airnet.net or sweetlac@smdc.army.mil

Otto W. Thiele
NASA Goddard Space Flight Center, Code 910.1, greenbelt, MD 20771
voice: 301 286-9006, fax: 301 286-1626, e-mail: thiele@trmm@gsfc.nasa.gov

Glenn Trapp
Aeromet Inc., PO Box 67, APO AP 96555
voice: 805 355-1508, fax: 805 355-2468, e-mail: trappg@kmr.ll.mit.edu

Jianxin (Jerry) Wang
NASA Goddard Space Flight Center, Code 910.1, Greenbelt, MD 20771
voice: 301 286-1594, fax: 301 286-1626, e-mail: wang@trmm.gsfc.nasa.gov

Christopher Williams
NOAA Aeronomy Laboratory, R/E/AL3, 325 Broadway, Boulder C0 80303-3328
voice: (303) 497-3829, fax: 303 497-5373, e-mail: chris@al.noaa.gov

Sandra Yuter
Department of Atmospheric Sciences, University of Washington, PO Box 351640, Seattle, WA 98195-1640
voice: 206 685-1073, fax: 206 543-0308, e-mail: yuter@atmos.washington.edu

Appendix A
Dimensions and Weights of the Instruments

A tipping bucket rain gauge has a cylindrical shape with 8” diameter and 18” height. It weights 8 lbs. The data logger within enclosure has the dimensions of The wooden base has a dimensions of 16x16” with 6” high.

A 2-D video disdrometer has two major components. The outdoor unit which consists of sensor, cooling, and electronics weights about 420 lbs with dimensions of 45” length, 26” width, and 45” high. When it is created, the unit weights 735 lbs with dimensions of 59x36x49". The indoor terminal has 17” monitor that can fit in a box of 16”x16”17” and weights about 40 lbs. The disdrometer supplements are yellow power cable of 63 lbs, black coax cable of 15 lbs, and plastic tools and parts box of 22 lbs.

A JHU/APL disdrometer unit has been put into a box of 14" wide, 24" long, 18.5" high and weights of 40 lbs. The dimensions of corresponding wooden base are 12" wide, 24" long and 6" high.

Appendix B
User Instructions for UNIDATA data loggers

<u>Downloading Data</u>
- to execute program at DOS level type command: *pdl* (from executable directory)
- From top level menu choose: "Use a Scheme"

Main Menu
Use a Scheme
Maintain Schemes
Maintain Instruments
Maintain MACRO Loggers
System Defaults
Test a Logger
QUIT

- Choose appropriate RG scheme from list

Choose a Scheme
DEFALT No Title
RMTEMP Average Room Temperature
RGAUGE Tipping Bucket

- The next menu that appears contains actions, which are used in conjunction with a particular scheme. The menu that appears is shown below:

Scheme: RGAUGE
List all Unload files
Display an Unload file
Delete an Unload file
Program Logger with Scheme
Unload data from Logger
Display Scheme Information
Print Scheme Information
Scheme Test mode
Incremental Unload

- When downloading data choose the "Unload data from Logger" option. Choosing this option immediately prompts the user to connect cables and to afterwards hit any key (the cables can be connected before even running pdl applications. Just hit any key in response to first prompt.) The DOS screen showing then prompts the user for a comment (we suggest entering the date of the download). After entering comment, hit return; this action initiates the data download. NOTE-Communication error messages occur occasionally. Ignore this message, if the download proceeds. Other errors can be indicative of a faulty logger. The ultimate test is whether the data download takes place.
- After downloading data, the program returns user to the preceding menu. The next step is to convert the downloaded binary file to an ASCII file. ASCII files are created with the "Display an Unload file" command shown in the menu above. Choosing this option provides the user with a list of all the download files associated with a given scheme. Choose the appropriate file (usually the most recent one in the list) using the up and down arrow keys; then hit return. The conversion only takes a second or two and writes out the name of the file generated. This filename should correspond to the name of the scheme. NOTE-if the name of the ASCII file differs from the scheme name, it is possible that the output details need to be modified. The procedure for doing this will be described below in a separate section.
- After converting binary the user can exit the program or select a different scheme.

<u>Uploading instrument configuration</u>
- Choose "Use a Scheme" and select the scheme to be loaded onto the logger.
- Select "Programmer Logger with Scheme" from menu. Hitting any key afterwards will load the scheme onto the logger.

NOTE - This procedure also initializes the logger. For KWAJEX we do not intend to initialize the loggers after each download unless it is discovered that the logger is recording spurious records, in which case, the problem should be documented along with the date of the site visit; after which, the logger should be reinitialized. Typically, this procedure would be followed on the next visit.

Testing a Logger

- Choose "Use a Scheme" and select the scheme to be loaded onto the logger.
- Select "Test a Logger" from menu. User can generate fictitious tips by moving mechanical bucket on rain gauge back and forth. If logger is working correctly the correct number of tips logged should appear at the temporal resolution of the scan rate (typically ~5-10 s). This screen should also tell you that is "primed" if it working correctly. This test is usually done during installations, but should not be done again unless the user has reason to think the gauge isn't working (i.e. empty file on download)

Editing Output Details

- If the scheme is configured correctly this step is unnecessary. Only follow these instructions if you note that the name assigned to the ASCII file is not the name of the scheme. In this case it is likely that the name was not properly edited in the original scheme configuration. NOTE - editing the output details does not affect the logger operation. It only affects the manipulation of files on the disk and so editing of the scheme can take place without loading a new scheme onto the logger.
- From Main Menu shown above choose "Maintain Schemes".
- From next menu choose "Edit a Scheme". Choose appropriate scheme.
- The next window that appears is shown below.

Edit Scheme: RGAUGE

General Details
Hardware Details
Program Details
Output Details
Save Scheme

- From above menu select Output Details.
- There are two options in the next menu that appears: choose "What to Print"
- In the next window choose "Edit a Report" and hit return twice. You should see a menu, which looks like what shown below.

Report Definition

Report Title	Tipping Bucket Events
Report Format	Ascii
File name / Device	RGAUGE$z.dat
Date format	mo/dd/yy
Time format	hh:mm:ss

- Edit the file name to match the scheme name. Make sure to include the wildcard character $z so that files get named sequentially in the order of their creation.

Appendix C
Field Maintenance and Data Archival for the JHU/APL Disdrometer

Upon encountering the Disdrometer in the field, note any anomalies and the general condition of the unit. Open the battery box by loosening two plastic slot-head screws. Use a voltmeter or multimeter to check the DC voltage of the battery. The battery must have a DC voltage greater than 11 volts. If it is below this value, the battery box should be replaced. Spare battery units will be provided for the Kwajalein experiment. The low battery can then be taken to the project office and recharged with a 12-volt trickle charger that will be provided.

Power up the laptop provided for the data archival. Laptops provided are PC type running Windows 98. The laptop will have in the carrying case, a 9 pin by 9 pin serial cable. Connect the cable to COM-1 on the laptop and turn on the computer. On the desktop is an icon named "Shortcut to APL". Double clicking this icon will open the HyperTerminal program and set the appropriate communication settings to "talk" to the processor on the Disdrometer. The communication settings are as follows:

8 data bits
No Parity
1 Stop Bit
9600 Baud

Note: in the properties section of HyperTerminal, the "Connect To" must be set to COM-1 and in the Port Settings, flow control should be set to XON/XOFF.

If for some reason, HyperTerminal is not available, any terminal program will work as long as the above communication parameters are used.

Once the terminal program is up and running with the correct communications parameters, plug the other end of the serial cable into the serial connector within the battery box. There is no need to disconnect the black waterproof power cable. When the serial cable is connected, the terminal screen will display text indicating that the systems are communicating and that the processor recognizes the flash card. Press <Enter> twice to bring up the processor menu. You will see the following menu selections:

A- Abort logging, enter TOM8 monitor
- Q- Resume data logging
- T- View tail-end of logged data
- C- Set Disdrometer's real-time clock
- V- Display PIC firmware version #
- D- Download contents of flash card

B- Change baud rate
- S- Scan flash card
- E- Erase flash card space

If there is no keyboard activity for 7 or 8 seconds, the unit will automatically go back into the data acquisition mode. If it does, just press <Enter> twice to bring the menu back.

First, press the "T" selection to view the tail end of the data. You should see several lines of numeric data scroll up the screen. The first three digits of the beginning of each data string should indicate a numeric Julian day value eg. 211 would indicate a Julian date of July 30th of this year. The Julian date will not necessarily be the current date, rather the data of the last data acquisition. After verifying that the unit has valid data strings, you may have to press Return twice to reactivate the menu.

The next step is to download the data by pressing the "D" selection on the menu. The unit will respond with an indication of how much data is on the flash card, and ask you if you want to download all of it. Respond by typing "Y" and pressing <Enter>. The unit will display a message indicating that you must prepare to capture the screen data. The prompt will remain suspended, and allow you to create and name a file to send the data to. To do this, you must go to the "Transfer" submenu at the top of the terminal screen, and select "Capture Text" from the pop-up window. This will bring up a file browser window, and allow you to name a file for the data, and specify a folder to put it in.

Please create a folder on the hard drive, and call it something like KWAJ_APLS, or something to describe a folder for storing data from the different units. Within the KWAJ_APLS folder, please create a separate folder for each unit that you visit. Each Disdrometer has a serial number on it with the format; w98-12, or w99-1. It is appropiate to give the serial number of the unit as the name of the folder.

When you are in the capture text window, browse to the appropriate folder, then in the "File" window, name the file with the current date, and append it with a ".txt" extension. For example, 07_24_99.txt. ***It is very important to make sure the file is entered in the correct folder for that Disdrometer***. Once you have named the file and selected the correct folder to put it in, press the "Start" button. This will return you to the terminal program, and you must press <Enter> to start the download. You should see the data scrolling on the screen.

The communication speed is set to 9600 Baud, and there is a selection to change the Baud rate. However, I have tried to use it, and have had no success. It tends to lock the system up or not work at all, or display "garbage" characters. I suggest not attempting to change the Baud rate.

The more data on the flash card, means longer download time. It is important to have your computer's battery fully charged when you go into the field (unless you are fortunate enough to have available an external power source). My experience is that a flash card with 6 MB of data on it will take just under 3 hours to download, so be prepared. Carry an external battery or at least an extra charged battery pack for your laptop.

Once the download is complete, you will see a message indicating "Transfer complete", and the menu will come up. At this time, close the terminal program and disconnect the serial connector from the connector in the battery box. Use Windows 98 Explorer to go to the folder where you put the file and make sure it is there. If the file is in the correct folder and you have correctly added a ".txt" extension to the file name, use Notepad to view the file and make sure the file has data in it. After verifying the file, go to the desktop and start the terminal program again using the "Shortcut to APL" icon. When the terminal program comes up, connect the serial cable from your laptop to the connector in the battery box and bring up the menu again.

Now you are ready to erase the flash card and re-initialize it. At the menu, type "E" to Erase flash card space. Type "Y" at the prompts to erase all of the flash card and to commence. It will take approximately 4 minutes to clear the flash card. Once the erase is complete, the menu will come up on the screen. Now you are ready to re-initialize the unit. Please keep in your mind that the memory of the flash card is 20 MB.

Press the "C" selection on the menu to Set Disdrometer's real time clock. The "Time?" prompt will appear with instructions above it. Type in the current date and time in the following format: YYMMDDHHMM. *Note: use 24-hour format for time*. 9907231641 would translate to year 1999, month July, 23rd day, and 4:41 p.m. If you type the format incorrectly, you will be notified, and allowed to re-enter. When the time is input correctly, you will see an indication, and the menu will come back up.

After you have set the real time clock, type "Q" to enter the acquisition mode, and when the Disdrometer goes into the acquisition mode, tap firmly on the white Delrin® head of the Disdrometer for five or six seconds. Then wait about 2 minutes for the processor to transfer the dummy data to the flash card. On the menu, type "T" to view the tail-end of logged data. You should see a few lines of text scroll up the screen. Use your up arrow to examine the data string. The beginning of the data should contain the Julian date and time equating to the time you input the dummy data. If this is the case, you may type "Q" to allow the processor to re-enter the acquisition mode, or just wait until it automatically goes back into that mode. Now you may shut down the terminal program and disconnect the serial cable from the connector in the battery box. Carefully seat the connector into the foam indentation and close the battery box. Tighten the screws firm but not overly tight. This will be end of the opearation.

Troubleshooting

The most common problem you will encounter is a lack of response once you connect the serial cable. If you see no response on the terminal screen, try pressing <Enter> several times. Some times the unit needs a little coaxing. If you still cannot get a response, disconnect the serial cable, restart the terminal program and reconnect the cable. If you still have no response, verify your communications settings for the terminal program, and make sure the serial cable is secure at both ends. As a last resort, close the terminal program and with the serial cable still connected, disconnect the black power cable from the Disdrometer. It may be hard to pull off. Bring the terminal program back up, and once you have the terminal screen, plug the cable back in, making sure that the small nipple on the rubber plug aligns with the notch on the Disdrometer's power connector. This is important, because if the pins are not aligned correctly you may bend or break a pin. Once you plug the power cable back in, you should get a response. If, after you follow the above procedures, there is still no response, the unit should go back to the project office where a qualified technician can open it up.

If the battery is found to be of low voltage, open up the battery box and in each of the 4 corners you will see screw mountings for the battery box. Use a long 7/16” hex socket head to remove the screws, and take the battery box off the metal base. Spare battery boxes should be available from the project office.

Notes

Use a log to indicate dates and times of downloads, specify file names, locations of files, size of files in Kb, unit serial numbers etc.

Note in as much detail as possible any anomalies, problems or observations you feel are relevant.

Do not remove the black waterproof connector except as suggested in troubleshooting section.

Clean any debris off the surface of the Disdrometer.

Please make sure to take the complete notes

Appendix D
Two-D Video Disdrometer Overview

Please see: http://www.iihr.uiowa.edu/about/meetings/overview.pdf